CSCE-608 Database Systems

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Sample Test Questions

1. True or false?

(a) In designing relational databases, we always desire our final tables to be in BCNF and we can always decompose any design to a BCNF design.

(b) A relation may have a number of candidate keys, but has only one primary key.

(c) If every attribute of a table functionally depends on the primary key, the table is in 3NF.

(d) $R(a, c) \bowtie S(a, d)$ is equivalent to $\pi_{a,c,d}(\sigma_{R.a=S.a}(R \times S))$.

(e) If X is a key of a relation R, X is also a superkey of R.

(f) Every relation that is in BCNF is also in 3NF.

(g) In relational algebra, two tuples for the relation $R(a, b)$, where a is the primary key of R, can have the same value for b.

2. Consider the schema $R = (A, B, C, D, E)$ together with the functional dependencies: $A \to C$, $AB \to D$, $CD \to E$. Is the relation R in BCNF? If not, convert it into relations in BCNF.

3. Consider the schema $R = (A, B, C, D, E)$ together with the functional dependencie $AB \to C$, $CD \to A$, $C \to E$, $C \to b$.

(a) What are the key(s) of R? Show your work to prove why each key is a key.

(b) Is $R(A, B, C, D, E)$ in BCNF? Why or why not? If not, decompose this relation into BCNF

(c) Is $R(A, B, C, D, E)$ in 3NF? Why or why not?

4. Give a formal proof for $(R \bowtie S) \bowtie T = R \bowtie (S \bowtie T)$.

5. Is $(R \bowtie_{C_1} S) \bowtie_{C_2} T = R \bowtie_{C_1} (S \bowtie_{C_2} T)$ true? If yes, give a formal proof, if no give a concrete example to show why it is not.

6. Suppose that we have two relations $R(a, b)$ and $S(c, d)$. For the following SQL query,

give two equivalent logical query plans in relational algebra such that one is likely to be more efficient than the other. Indicate which one is likely to be more efficient and explain why:

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SELECT R.a, S.d
FROM R, S
WHERE R.b = S.c AND R.a < 0 AND S.d > 0
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7. For each of the following equivalences, state whether they are TRUE or FALSE. If they are FALSE, provide examples proving that the equivalence does not hold.

(a) $R = R \cup_S R$.

(b) $R = R \cup_B R$.

(c) $\sigma_p(R - S) = \sigma_p(R)S$.

(d) $\sigma_{p \vee q}(R \bowtie S) = \sigma_p(R) \bowtie \sigma_q(S)$. ($p$ is a condition involving attributes of R and q is a condition involving attributes of S.)

8. Consider two relations $R(A, B, C)$ and $S(B, C, D)$. Rewrite the query plan

$$\sigma_B(\sigma_{A=C} \bowtie \sigma_{D>0})$$

into an equivalent one that has the selections pushed down as far as possible.